

Article XX.—THE NORTH AMERICAN ANTS OF THE GENUS LIOMETOPUM.

By WILLIAM MORTON WHEELER.

The soft, velvety ants of the remarkable Dolichoderine genus *Liometopum* Mayr appear to be confined to the south temperate portions of the northern hemisphere. So far as known, Europe, Asia, and North America each has a characteristic species. The large male of the European form, *L. microcephalum*, was described more than a century ago by Panzer¹ although the corresponding worker form was not discovered till more than fifty years later by Mayr.² This author was also the first to publish a brief description of the worker of our American species, *L. apiculatum*, from specimens collected in Mexico by Professor Bilimek.³

In 1894 Emery⁴ described some Californian specimens as a new variety (*occidentale*) of the European *microcephalum*, but, as I shall endeavor to show, this form had best be regarded as a variety of *apiculatum*. More recently Forel has described a third species from Assam as *L. lindgreeni*.⁵

In addition to these three living species four fossil forms have been recorded from the Tertiary of Europe and North America: *L. antiquum* Mayr, *imhoffi* Heer, and *L. schmidti* Heer from Radoboj,⁶ and *L. pingue* Scudder from White River, Utah, and Green River, Wyoming.⁷ These species, however, were all described from imperfectly preserved male and female specimens more or less dubiously referable to the genus *Liometopum*.

During my myrmecological excursions into the southwestern States and Territories I have frequently met with our American *Liometopum* and have been able to learn something of its habits. Specimens of these ants from a number of localities have been accumulating in my collection till it seems to me to be possible to form a better conception of the geographical distribution of the species.

¹ Fauna Insect. German., V, 1798, P. 54, T. 2.

² Beschreibung einiger neuer Ameisen. Verhand. zool. bot. Ver. Wien, Bd. II, 1852, p. 144.

³ Neue Formiciden. Verhand. zool. bot. Gesell. Wien, XX, 1879, p. 961.

⁴ Beiträge zur Kenntniss der nordamerikanischen Ameisenfauna. Zool. Jahrb. Abth. f. Syst., VIII, pp. 330, 331.

⁵ Variétés Myrmécologiques. Ann. Soc. Ent. Belgique, Tome XLVI, 1902, p. 293.

⁶ Vorläufige Studien über die Radoboj-Formiciden. Jahrb. k. k. geolog. Reichsanst., 1867, XVII, pp. 57-61, Taf. 1.

⁷ On the First Discovered Traces of Fossil Insects in the American Tertiaries. Bull. U. S. Geol. Surv. Terr., III, 1877, p. 742; The Tertiary Insects of North America. U. S. Geol. Surv. Terr., 1890, p. 617.

Emery was under the impression that there were two species of *Liometopum* in North America, *L. apiculatum* Mayr, originally described from Mexico, and *L. microcephalum* Panz. var. *occidentale* Emery from California. Both of these forms are very closely related to the typical European species and he was undoubtedly right in considering the relationship especially close in the case of *occidentale*, since this form has the color and sometimes also the more rounded petiolar node of *microcephalum*. But an examination of a great number of workers from many colonies shows that all our American *Liometopa* agree in having a more or less pointed petiole and a very different arrangement of the dense pubescence on the gaster. Emery first called attention to the fact that this pubescence in *occidentale* is parted at the median dorsal line and diverges on either side instead of converging towards the median line, as in *microcephalum*. (Conf. Fig. 1 *a* and *d*.) The same is equally true of the typical *apiculatum*, and as both this character and the usually very pointed petiole are common to all our American forms, including a new subspecies to be described below, I do not hesitate to refer them all to Mayr's original Mexican species.

DESCRIPTIONS OF AMERICAN LIOMETOPA.

Liometopum apiculatum Mayr.

Liometopum apiculatum MAYR, Verhandl. k. k. zool. bot. Ges. Wien, XX, 1870, p. 961. ♂.

Liometopum apiculatum DALLA TORRE, Catalog. Hymenopt., VII, 1893, p. 163.

Liometopum apiculatum EMERY, Zool. Jahrb. Abth. f. Syst., VIII, 1894, p. 331. ♀.

Liometopum apiculatum FOREL, Biol. Centrali Amer. Insect. Hymenopt., III, 1899-1900, p. 104.

Liometopum apiculatum VIERECK, Trans. Am. Ent. Soc., XXIX, 1903, p. 71. ♀.

Worker (Fig. 1, *a* and *b*).—Length 2.5-6 mm.

Mandibles with about ten teeth on the apical and four or five very small ones on the basal border. Head cordate, as broad as long, in large workers sometimes broader than long, with broadly excised posterior border and rounded sides. Clypeus somewhat bulging at the lateral corners, with a straight anterior border. Frontal area very indistinct. Frontal groove lacking. Eyes in front of the middle of the head. Ocelli, even in the largest workers, very small and indistinct. Antennal scape curved at the base, its tip reaching to the posterior corner of the head. Funiculus but slightly thickened towards the tip; all the joints longer than broad, first and last joints longest, intermediate ones growing shorter distally. Thorax conspicuously narrower than the head, laterally compressed in the meso- and metathoracic regions; in profile rather flat above, with very distinct promesonotal and mesoepinotal sutures; seen from above the pro-

and epinotum are of about the same length, the mesonotum somewhat shorter. Petiole produced upward into a sharp point which in some specimens may be prolonged into a soft spine; in profile inclined forward and more or less flattened or even concave both on the anterior and posterior surfaces. Gaster large, elongate elliptical, its anterior segment more or less completely concealing the petiole. Legs rather slender.

Mandibles shining, coarsely punctate towards their tips, finely and densely punctate towards their bases. Body subopaque; clypeus, head, and often also the thorax shining; finely but distinctly reticulate or coriaceous, as are also the appendages.

Body and appendages clothed with gray pubescence, so long and dense on the gaster as to hide the smooth ground surface. On the first, second, and third segments it is parted at or diverges on either side of the mid-dorsal line in such a manner as to give the gaster a shifting silky lustre somewhat like that seen on the abdomens of certain Diptera (*Sarcophaga* e. g.).

Hairs gray, long, and sub-erect, especially on the head, upper surfaces of the thorax and gaster, and on the legs; short and inconspicuous on the antennal scapes.

Body dark brown or black, with the mandibles, sides of the clypeus, cheeks, and more or less of the thorax, legs, and antennae reddish yellow or light brown; the amount and distribution of the light color varying considerably even in workers of the same colony. Mandibular teeth black.

Female (Fig. 1, c).—Length 12–13 mm.

Apart from the much larger size and the usual sexual characters, the female differs from the worker in being black in color, in having darker mandibles, clypeal corners, legs, and antennae, and in the arrangement of the gastric pubescence which is not parted and divergent but straight and uniform. The erect hairs are proportionally shorter, but denser and more abundant than in the worker. Wings long (18 mm.), brownish hyaline, with brown veins and black stigma. Petiole high and lyrate when seen from behind, with a deep notch in the summit, so that it appears to be prolonged at the apex into two slightly diverging points.

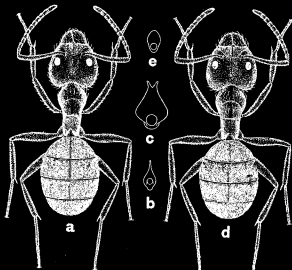


Fig. 1. a, *Liometopum apiculatum* Mayr. Worker; b, petiole of same seen from behind; c, petiole of female; d, *L. microcephalum* Panzer, Worker; e, petiole of same.

Male.—Length 9 mm.

Head very small, barely half as broad as the thorax, rounded behind, with short, flat cheeks, prominent eyes and ocelli. Mandibles and clypeus like those of the worker; antennae long; scape but little thicker than the uniformly cylindrical funiculus; as long as the first and second funicular joints together; first funicular joint more than half as long as the second; third to last joints subequal, a little shorter than the second. Thorax very robust, broadly elliptical from above; mesonotum in profile high and arched. Petiole low and rather thick, its edge broadly rounded and notched in the middle. Gaster very short, convex above. Genital valves very large; outer pair broadly rounded above, with a short, rounded inferior lobe; median pair produced behind into a short, triangular, pointed process which has its dorsal margin broadly excised at the base and the apical margin coarsely dentate. Legs slender. Wings long (14 mm.).

Body more opaque than in the worker and female, owing to the sharper reticulation of the head and thorax.

Hairs and pubescence tawny or golden, distributed as in the female; except that the antennal scapes bristle with numerous erect hairs.

Body and appendages black, mouth-parts and inner genital valves yellowish. Wings of the same color as in the female.

Types from "Mexico," in the collection of Dr. Gustav Mayr of Vienna.

The above description is drawn from numerous workers collected by Mr. C. H. Tyler Townsend on the volcano of Colima, Mexico (7500 ft.), a dealated female from Mexico, received from Dr. Mayr, and a winged female and a single male from Arizona (Am. Mus. Nat. Hist. Coll.). Forel records the species from Pinos Altos, Chihuahua, and Ciudad in Durango, Mexico (8100 ft.). I have seen numerous workers from the following localities: Cañón City (5329 ft.) and Cotopaxi (6371 ft.), Colorado (P. J. Schmitt, O. S. B.); Manitou (6309 ft.), Garden of the Gods, and Cheyenne Cañon (7000 ft.), Colorado; Paisano Pass (5079 ft.) and Ft. Davis (5400 ft.), Texas; Las Vegas (6398 ft.) (W. M. Wheeler), Las Vegas Hot Springs (6726 ft.), and Romeroville (6303 ft.), New Mexico (T. D. A. Cockerell); High Rolls (6550 ft.), Alamogordo (4320 ft.) and Beulah (8000 ft.), New Mexico (H. Viereck). Two dealated females were taken at Manitou and one at Ft. Davis. The workers from Colorado often have the thorax rather pale, so that they approach very closely to the var. *occidentale* Emery (*vide infra*), but I believe that this name should be restricted to the Californian form.

***Liometopum apiculatum* Mayr var. *occidentale* Emery.**

Liometopum microcephalum PANZER var. *occidentale* EMBERY, Zool. Jahrb. Abth. f. Syst., VIII, 1894, pp. 330, 331. ♂, ♂.

Worker.—Differs from the typical *apiculatum* in having the thorax and petiole

of a clearer and more yellowish red color, although in many specimens the pro- and mesonotum are spotted with black or fuscous. In some individuals the node of the petiole when seen from behind is somewhat rounder and more like that of the European *microcephalum*. On the antennal scapes there are erect hairs, which are lacking in all my specimens of the typical *apiculatum*. This character will serve to distinguish *occidentale* from the similarly colored workers of *apiculatum* often seen in Colorado.

The types are from San Jacinto (1533 ft.) and Mariposa (1962 ft.), California (Collection of Professor Emery at Bologna).

My specimens were taken near Baldy Peak, San Gabriel Mountains, California (6500 ft.), by Messrs. Brewster, Joos, and Crawford, and near Claremont, California (1141 ft.), by Professor C. F. Baker.

***Liometopum apiculatum luctuosum* subsp. nov.**

Worker.—Length 2.5–4.5 mm.

Apart from its somewhat smaller size, the worker of this subspecies differs from the typical *apiculatum* in sculpture, pilosity, and color. The body is much smoother and more shining. The pubescence is shorter even on the gaster so that the smooth surface is more apparent, and there are only a few rather short, erect hairs on the upper surface of the body and none on the legs or antennal scapes. All the specimens are black or very dark brown, with the mandibles, lateral corners of the clypeus, the mouth, and in some specimens also the funiculi or even the scapes of the antennæ dark red or yellowish red. Insertions of antennæ and articulations of legs yellowish.

The types of this well-marked form are from Cheyenne Cañon (7000 ft.) near Colorado Springs, Colorado. I have also taken it at Prescott, Arizona (5320 ft.), in the Coconino forest on the rim of the Grand Cañon of the Colorado (6865–7050 ft.), and down the Bright Angel Trail to an altitude of about 4000 feet. A number of workers were also collected by Messrs. Brewster, Joos, and Crawford near Baldy Peak in the San Gabriel Mountains, California (6500 ft.).

THE HABITS OF LIOMETOPUM.

L. apiculatum is structurally so closely related to the European *microcephalum* that we should expect to find a similar close resemblance in habits. Generally speaking, this proves to be the case. There are, however, a number of rather important ethological differences, which leave no doubt that the American is sufficiently distinct from the European form to be regarded as a "good" species.

The habits of *L. microcephalum*, which seems to be common in Asia Minor and southern Europe (excepting France and Spain¹),

¹ According to Br. André, *Species des Hyménoptères d'Europe et d'Algérie*, 1882, p. 220.

have been studied by the leading myrmecologists, Mayr, Emery, and Forel. Mayr's account,¹ which is the earliest, may be quoted in full:

"This beautiful species probably establishes its colonies in hollow trees, since I have been unable hitherto, notwithstanding many attempts, to find its nests. It wanders about in processions ascending trees, where it could go only for the purpose of attending plant-lice. During the past three years I have repeatedly visited a couple of silver poplars standing close together and have always found this ant moving in a procession from one tree to the other, but I have been unable to discover either the nests or the winged sexes. The processions are often very long and are permanently maintained throughout the whole summer, since the workers go back and forth. Such a procession is to be seen, for example, in the Prater in Vienna, extending between four trees and measuring 180 feet in length. This procession also sends out to one side another which measures 72 feet in length and leads to two other trees."

Emery gives a more extensive account of this ant which he found to be common in Italy where it is associated almost exclusively with oak trees.² Between these it forms processions or files sometimes 240 feet in length. "This ant seems neither to build nor to excavate its nests, but uses the cavities and galleries dug in the wood or under the bark by the larvæ of stag-beetles (*Lucanus*), longicorns (*Cerambyx*), or other large wood-eating beetles. No other tree presents such commodious and convenient cavities of this description as the oak. . . . This ant's mode of life is largely external. It patrols great surfaces; nearly every crevice in the bark of the trees which it inhabits being used by a file of ascending and descending workers. During the hottest hours of the summer days they withdraw into their cavities, but at other times nearly all the individuals keep running about outside of the nest." Emery maintains that they do not attend aphides in order to collect their sweet ejecta, but carry these insects away as food. "*Liometopum* is preëminently a predatory ant and lives almost exclusively on animal food. . . . It runs about on the bark of the trees awaiting the coming of other insects, which it seizes. It institutes veritable *battues* for larger game. . . . While on these hunting expeditions the *Liometopum* workers always rely on the same method of quickly overwhelming their prey from all sides and holding it fast. They also behave in the same manner in their conflicts with other ants." Besides the files, which connect the various

¹ *Formicina Austriaca*. Verhandl. k. k. zool. bot. Gesell. Wien, V, 1855, p. 319.

² *Zur Biologie der Ameisen*. Biol. Centralblatt, 1891, pp. 165-180.

nests of a *Liometopum* colony with one another, there are other very long files which radiate out in different directions. These Emery calls "predatory or hunting files." He describes the huge males and females preparing for their nuptial flight on a July evening. The wings of the females are very easily detached. These insects were never seen to take flight voluntarily and when precipitated into the air from the tip of the finger, they flew horizontally like termites and permitted themselves to drift with the wind. He believes that mating must take place on the trees during the twilight hours and that the lumbering females take flight from the highest twigs. He is also of the opinion that *Liometopum* is an ant of which the female is gradually losing the power of flight.

Forel had occasion to study *L. microcephalum* in Bulgaria¹ and was able to confirm many of Mayr's and Emery's observations: "*Liometopum*, as a rule, forms enormous colonies which often extend over several trees connected by files of ants going back and forth. In an old oak forest near Aëtos (comprising the largest and most beautiful oaks I have ever seen) I found a *Liometopum* colony which covered twelve huge nests. In order to ascertain whether the *Liometopum* on some more distant oaks were also members of this same colony, I brought workers from the two places together. Those from the more distant oaks were attacked and pulled about, not very seriously, but with sufficient vehemence to prove that they belonged to another colony. I found *Liometopum* colonies on oaks, poplars, willows, apricot trees (which are often very large in eastern Rumelia), and elms.

"The nest entrances are often found in spots on the tree-trunks where the bark is defective, or in dead branches, but also quite as frequently in very hard wood, so that it is very difficult to obtain a piece of the nest. In Sliven, nevertheless, I succeeded in sawing off and carrying home a dead branch inhabited by *Liometopum*. It certainly looks as if only the borings of beetles had been used; but the cavities are in all probability enlarged by the ants.

"*Liometopum* is a fiercely pugnacious ant and angrily attacks and bites the intruder. At the same time it emits (evidently from its anal glands) a secretion which Emery has described as intensely aromatic and very similar to that of *Tapinoma erraticum*. As soon, however, as the first odor has evaporated, another penetrating and more disagreeable odor, which recalls that of *Lasius emarginatus*,

¹ Die Ameisenfauna Bulgariens. Verhandl. k. k. zool. bot. Gesell. Wien, 1892, pp. 305-318, Taf. V.

becomes perceptible. Emery has called attention to this mixture of odors. The secretion makes the fingers sticky, which proves that there is a resinous residue as in the case of *Tapinoma*.

"Alien ants are fiercely persecuted by *Liometopum*. With the exception of *Polyergus rufescens* and *Solenopsis geminata* I have never seen a more powerful or pugnacious ant. In Tatar-Bagardjik I witnessed a spontaneous battle between a small and apparently very young *Liometopum* colony and a colony of *Lasius niger*. The former was up on the trunk of an elm, the latter down at the base and had evidently been in the habit of visiting plant-lice on the tree. The *Liometopum* colony, which had probably only recently taken up its abode in the elm, attacked the *Lasius* in serried columns, and with a show of determination, sure and rapid movements, and coöperation, succeeded in putting them to flight. The *Lasius* rallied but could not manœuvre and intercommunicate so readily. The rapidity with which the *Liometopum* communicate with one another and assemble in force for the purpose of overwhelming an enemy is truly wonderful. On such occasions a faint crackling sound is heard. Hardly any other animal dares venture up onto trees inhabited by *Liometopum*. Only long-legged ants that can get over the ground very rapidly endeavor to run the gauntlet in order to reach the plant-lice, which are heartily despised by the *Liometopum*."

There appeared as a postscript to Forel's paper on the ants of Bulgaria a brief note by Mayr. In this he describes, and on an adjoining plate figures, a nest of *L. microcephalum* found in a hollow oak in southern Hungary: "The material used was finely comminuted, decayed wood which undoubtedly had been compacted by means of some glandular secretion to form a brown substance like papier-maché. This substance was built up into short curved trabeculae which branched and anastomosed like the meshes of a net, or in the form of small pasteboard-like plates, variously bent and perforated with numerous openings as large as pin-holes or larger. The paper nests of *Lasius fuliginosus* differ from those of *Liometopum* mainly in that they consist exclusively of pasteboard-like plates." In commenting on this observation at the end of the paper, Forel admits that he and Emery probably saw only the peripheral portions or outskirts of the *Liometopum* nest and that the paper portions are probably situated in the very heart of the tree-trunk. In other words, it is probable that the beetle-borings described by Emery and Forel are not a part of the true nest of *L. microcephalum*, but are merely used as runways or forecourts to the true penetralia in which

the ants keep and raise their brood. This casts some doubt on the statements of Emery and Forel implying that a single colony of *microcephalum* has more than one nest.

It is evident that the American *L. apiculatum* has two peculiarities not observed in the European form. First, it is more highly variable than its Old World cousin, as is shown by the existence of at least one subspecies and one variety, and second, the altitudes recorded in connection with the localities in which it has been taken, show that it is confined to mountainous regions. The typical *apiculatum* and its subspecies *luctuosum* are, in fact, known to occur only at altitudes between 4000 and 8000 feet. They seem to be most abundant at 5000-6000 feet. It is true that most of the altitudes recorded for the variety *occidentale* are much lower, but it must be remembered that these are somewhat problematical. San Jacinto, Mariposa, and Claremont, which appear on the labels of the Californian specimens, are near the San Jacinto and San Gabriel ranges and the ants may have been actually taken at higher altitudes but attributed to the nearest towns. This dependence on rather high altitudes readily accounts for the fact that *L. apiculatum* does not occur in eastern North America. In that region, as I have shown in a former paper,¹ the genus *Liometopum* is represented, both taxonomically and ethologically, by the genus *Dolichoderus*.

I have observed many colonies of the typical *apiculatum* in the Paisano Pass and at Ft. Davis, Texas, at Las Vegas, New Mexico, and in the mountains about Manitou and the Garden of the Gods. These ants, like the European species, are continually moving back and forth in files,² often 100-200 feet long, over and under the loose rocks, ascending and descending the trees and bushes. They run with a soft, bounding gait, which, with their velvety bodies and warm gray tints, makes them resemble a host of Lilliputian mice. When disturbed they quickly turn their gasters up or to one side, towards the intruder, and emit a secretion which has a rank rancid-butter, or "Tapinoma" odor.

In their choice of nesting sites they differ from the European form precisely as the North American *Dolichoderi* differ from their European congeners: they nest in the ground, often some distance from the trees or plants on which they seek their food. I have seen nothing to prove that a single colony of *L. apiculatum* occupies more than one

¹ The North American Ants of the Genus *Dolichoderus*. Bull. Am. Mus. Nat. Hist., XXI, 1905, pp. 305-319.

² In the Paisano Pass even on cold but sunny days in the latter part of December.

nest. June 10, 1902, I happened on a huge nest of this species on the "Crouching Lion" at Ft. Davis. It was fully two feet long and a foot and a half wide, and was situated in the ground under a large flat stone. A year or two previously the stone must have rolled down a slope onto some coarse grass and twigs and the ants had built up the earth in the interstices between these vegetable remains and compacted it with some glandular secretion till it formed a huge mass of trabeculæ, much coarser and with larger openings but otherwise similar to that figured by Mayr for the European species. The nest contained thousands of workers and fully a quart of glistening white worker larvæ and pupæ. The ants attacked me with great fury and nearly suffocated me with their intense butyric acid odor. This nest was situated in an open stony region at least 200 feet from the nearest trees. Another smaller nest of similar construction was found under a stone in the Paisano Pass, near Alpine, Texas. The specimens of *apiculatum* collected by Mr. C. H. Tyler Townsend on the volcano of Colima are also from a "large nest in the ground and dead leaves under a log." That these insects habitually build in the soil is also shown by the fact that on four different occasions, twice at Ft. Davis and twice near Manitou, I came upon isolated females in the act of establishing their colonies in small cavities excavated in the soil under stones in rather open places. One of these insects had a packet of eggs, another a packet of larvæ, and a third, that had recently died, probably from hunger or exhaustion, was being devoured by a colony of a small species of *Solenopsis* allied to *S. validiuscula* Emery. These huge females, with the exception of the females of *Atta fervens* and our larger *Camponoti*, the largest and most obese of their sex among North American ants, are thus seen to establish their colonies in the same manner as the vast majority of Formicidæ.

While collecting in Colorado during the summer of 1903, I made repeated attempts to get at the nests of *Liometopum*, which was very common in the Garden of the Gods, where it prefers the red volcanic rocks and soil just as it does in the Paisano Pass and at Ft. Davis. The files of ants were often seen disappearing under rocks, but when these were lifted in the hope of finding their nests, it was found that only a runway or perhaps a succursal nest had been uncovered. In vain rocks were removed over large surfaces, only to find the burrow at last disappearing into the ground under the roots of some great tree, immovable boulder or cliff. The fact that in these runways the ants often congregate in numbers, together with the myrmecophilous beetles mentioned below, is apt to lead the ob-

server to believe that he has found the nest, but these cavities contain no larvæ, males, or females, and careful inspection shows that they lead off into a continuation of the runway. The cavities are, in fact, mere temporary resting places for the out- and home-bound companies of workers.

It is, perhaps, easy to account for the difference in the nesting-sites of the European and American species of *Liometopum* when we consider the great climatic differences between southern Europe and the mountainous regions of southwestern North America. The protracted periods of drought in the latter regions make the decayed wood of tree-trunks extremely undesirable abodes for moisture-loving insects like the ants. They are therefore compelled to nest in the soil and naturally seek places under stones where the moisture is longest retained.

If the observations of Emery and Forel can be accepted as final, there is also another great ethological difference between the American and European species of *Liometopum*, a difference relating to the feeding habits. Mayr was of the opinion that *L. microcephalum* could be climbing about on the trees only for the purpose of attending aphides, but Emery claims that the ants merely devour these insects and Forel speaks of their despising the plant-lice. Our American species, however, is eminently aphidicolous and coccidicolous, although, like *microcephalum*, it is always ready to feast on any caterpillars, beetles, etc., that may fall in its path. In the Paisano Pass the files of *apiculatum* were frequently seen attending the aphides on the leaves of two species of mountain oak (*Quercus emoryi* Torr. and *Q. undulata* Torr.). At Ft. Davis I found thousands of these ants in attendance on a lot of aphides that covered the flower spikes of some large yuccas. Another colony was similarly engaged on the leaves of willows and cedars. At Manitou similar observations were made. Here they were also attending snow-white Coccidæ on roots that extended across their dark runways. These ants love to collect the nectar of flowers. In the Paisano Pass a colony was busy plundering the blossoms of the cat's claw (*Acacia wrightii* Benth.). At Ft. Davis I saw unmistakable evidence of their pronounced carnivorous instincts. A file was dragging caterpillars to its nest and a mass of ants were trying to get at the soft parts of a dead specimen of one of our largest longicorn beetles (*Derobrachus geminatus* Lec.), measuring 6.5 cm. in length. These diverse observations show the close resemblance in habits between the species of *Liometopum* in the western and the species of *Dolichoderus* in the eastern states of the Union.

My observations on the dark-colored *luctuosum* are much less complete than those on the typical *apiculatum*, owing to the fact that I saw only two colonies of the subspecies in Colorado and one at Prescott, and was unable to devote much time to observing the more numerous colonies found on the rim of the Grand Cañon. *L. luctuosum* seems always to be associated with pine trees. At any rate, the colonies in Cheyenne Cañon, Colorado, and at Prescott were ascending the trunks and had their nests under the large roots of pines. *L. luctuosum*, moreover, was the only form of the species seen in the Coconino pine forest on the rim of the Grand Cañon.

Notwithstanding its restless activity and highly carnivorous instincts, *L. apiculatum* seems to tolerate quite a number of myrmecophiles. In the runways of this ant in the Paisano Pass two different Tenebrionid beetles (*Ologlyptus anastomosis* Say and *Argoporis* sp.) and a Thysanuran (*Atelura* sp.) were frequently met with. These are probably merely synœketes, or indifferently tolerated guests. Two truly myrmecophilous beetles, however, belonging to the Aleocharine Staphylinidæ, namely, *Apteronina schmitti* and *Dinardilla liometopi*, both described some years ago by Wasmann,¹ are known to occur only with *L. apiculatum*. They were discovered by the late Rev. P. J. Schmitt, O. S. B., at Cotopaxi, Colorado, not in the "nest of *Liometopum*," as Wasmann states, but in the runways of these ants, as Father Schmitt once informed me. These beetles were sought in vain in the Paisano Pass

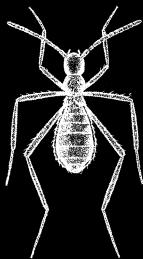


Fig. 2. *Apteronina schmitti*
Wasmann.

and at Ft. Davis, but I had no difficulty in finding them in the Garden of the Gods and in Cheyenne Cañon near Colorado Springs. There were sometimes as many as four or five of each species under a single stone covering one of the runways. They seem to lie in wait and take toll in the form of honey-dew from the ants that are traversing the burrow on their way to the nest. According to Wasmann, "the structure of the tongue of *Apteronina* indicates that this insect is fed from the mouth of its hosts, like *Atemeles*,

¹ Zwei neue *Liometopum*-Gäste aus Colorado. Wien Entomol. Zeitung, 20. Jahrg., 7. Heft 30 Sept., 1901, pp. 145-147.

Lomechusa, etc." These beetles are of more than usual interest because they are both tactual mimics, that is, they probably deceive the ants through a resemblance in form or surface texture to the *Liometopum* workers. While both beetles are highly pubescent, like these workers, they differ greatly in form; *Apteronina* being decidedly ant-like, whereas *Dinardilla* has the form of beetles which ants have considerable difficulty in seizing or holding in their mandibles. According to Wasmann, *Dinardilla* is allied to *Dinarda*, a genus comprising several interesting European myrmecophiles. *Apteronina*, according to the same authority, resembles *Apteronillus* and even more closely several *Eciton* guests of the mimetic type. Probably both of the *Liometopum* guests are in the habit of accompanying their hosts as they move along in files. In this respect the relationship of *Apteronina* with *Apteronillus* and its allies is very suggestive, since the *Eciton* guests are actually known to accompany the files of their nomadic hosts.

A study of the behavior of *Dinardilla* and *Apteronina* in artificial nests would undoubtedly yield interesting results. While I was in Colorado there were so many matters of myrmecological interest to occupy my time and attention, that I unfortunately neglected to observe these beetles under suitable conditions. I include a couple of sketches (Figs. 2 and 3) that may aid some future observer in identifying these singular creatures.



Fig. 3. *Dinardilla liometopi*
Wasmann.